

## CLAIMS

- 1 1. A magnetic head including a read head structure, comprising:  
2 a free magnetic layer, including a central region and outwardly disposed end regions  
3 thereof;  
4 at least two anti-parallel coupled magnetic layers being disposed above said end regions  
5 of said free magnetic layer.
- 1 2. A magnetic head as described in claim 1 wherein a thin film nonmagnetic layer is  
2 disposed between said at least two said magnetic layers.
- 1 3. A magnetic head as described in claim 1 wherein a magnetic seed layer is disposed on top  
2 of said end regions of said free magnetic layer, and a first one of said at least two magnetic layers  
3 is disposed on top of said seed layer
- 1 4. A magnetic head as described in claim 3 wherein said seed layer is formed with a BCC  
2 crystal structure.
- 1 5. A magnetic head as described in claim 4, wherein said seed layer is comprised of  
2 CoFeCr, and has a thickness of from approximately 10 Å to approximately 50 Å.

1 6. A magnetic head as described in claim 3 wherein a thin film nonmagnetic layer is  
2 disposed on top of said first magnetic layer, and a second one of said at least two magnetic layers  
3 is disposed on top of said nonmagnetic layer.

1 7. A magnetic head as described in claim 6 wherein said first and second magnetic layers  
2 are comprised of CoPtCr, and said first magnetic layer has a thickness that is from approximately  
3 20 Å to approximately 30 Å and said second magnetic layer has a thickness of from  
4 approximately 30 Å to approximately 80 Å.

1 8. A magnetic head as described in claim 7 wherein said non-magnetic layer is comprised of  
2 Ru and has a thickness that is approximately 8 Å.

1 9. A magnetic head as described in claim 7 wherein said seed layer has a thickness, and the  
2 total thickness of said seed layer plus said first magnetic layer is greater than the thickness of  
3 said second magnetic layer.

1 10. A magnetic head as described in claim 1, wherein said anti-parallel coupled magnetic  
2 layers have a net magnetostatic field in the same direction as a magnetic field of said free layer.

1 11. A magnetic head as described in claim 3, wherein a third thin film magnetic layer is  
2 disposed between said first magnetic layer and said nonmagnetic layer, and a fourth magnetic  
3 layer is disposed between said nonmagnetic layer and a second magnetic layer.

12. A magnetic head as described in claim 11, wherein said third magnetic layer and said fourth magnetic layer are comprised of CoFe.

13. A magnetic head including a GMR sensor, comprising:

a plurality of thin film layers forming a GMR sensor, wherein at least one of said layers is a free magnetic layer, said free magnetic layer including a central portion and two outwardly disposed end regions thereof;

a magnetic seed layer being disposed upon said end regions;

a first magnetic layer being disposed upon said seed layer;

a nonmagnetic layer being disposed upon said first magnetic layer;

a second magnetic layer being disposed upon said nonmagnetic layer;

wherein said first magnetic layer is formed with a magnetic field and said second magnetic layer is formed with a magnetic field, and wherein the magnetic fields of said first magnetic layer and said magnetic layer are anti-parallel coupled.

14. A magnetic head as described in claim 13, wherein said free magnetic layer is formed with a magnetic field in a first direction and said anti-parallel coupled magnetic field of said first magnetic layer and said second magnetic layer is formed with a magnetostatic bias in the same direction as the magnetic field of said free magnetic layer.

15. A magnetic head as described in claim 13 wherein said seed layer is formed with a BCC crystal structure.

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1 16. A magnetic head as described in claim 15 wherein said seed layer is comprised of  
2 CoFeCr, and said first magnetic layer is comprised of CoPtCr, and said nonmagnetic layer is  
3 comprised of Ru, and said second magnetic layer is comprised of CoPtCr.

1 17. A magnetic head as described in claim 16 wherein a layer being comprised of CoFe is  
2 disposed between said first magnetic layer and said nonmagnetic layer, and a second layer  
3 comprised of CoFe is disposed between said nonmagnetic layer and said second magnetic layer.

1 18. A hard disk drive including a magnetic head having a read head structure, comprising:  
2 a free magnetic layer, including a central region and outwardly disposed end regions  
3 thereof; at least two anti-parallel coupled magnetic layers being disposed above said end regions  
of said free magnetic layer.

1 19. A hard disk drive as described in claim 18 wherein a thin film nonmagnetic layer is  
2 disposed between said at least two magnetic layers.

1 20. A hard disk drive as described in claim 18 wherein a magnetic seed layer is disposed on  
2 top of said end regions of said free magnetic layer, and a first one of said at least two magnetic  
3 layers is disposed on top of said seed layer

1 21. A hard disk drive as described in claim 20 wherein said seed layer is formed with a BCC  
2 crystal structure.

1 22. A hard disk drive as described in claim 21, wherein said seed layer is comprised of  
2 CoFeCr, and has a thickness of from approximately 10 Å to approximately 50 Å.

1 23. A hard disk drive as described in claim 20 wherein a thin film non-magnetic layer is  
2 disposed on top of said first magnetic layer, and a second one of said at least two magnetic layers  
3 is disposed on top of said non-magnetic layer.

1 24. A hard disk drive as described in claim 23 wherein said first and second magnetic layers  
2 are comprised of CoPtCr, and wherein said first magnetic layer has a thickness that is from  
3 approximately 20 Å to approximately 30 Å and said second magnetic layer has a thickness that is  
4 from approximately 30 Å to approximately 80 Å.

1 25. A hard disk drive as described in claim 24 wherein said non-magnetic layer is comprised  
2 of Ru and has a thickness that is approximately 8 Å.

1 26. A hard disk drive as described in claim 24 wherein said seed layer has a thickness, and  
2 the total thickness of said seed layer plus said first magnetic layer is greater than the thickness of  
3 said second magnetic layer.

1 27. A hard disk drive as described in claim 18, wherein said anti-parallel coupled magnetic  
2 layers have a net magnetostatic field in the same direction as a magnetic field of said free layer.

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1 28. A hard disk drive as described in claim 20, wherein a third thin film magnetic layer is  
2 disposed between said first magnetic layer and said non-magnetic layer, and a fourth magnetic  
3 layer is disposed between said non-magnetic layer and a second magnetic layer.

1 29. A hard disk drive as described in claim 28, wherein said third magnetic layer and said  
2 fourth magnetic layer are comprised of CoFe.

1 30. A method for fabricating a read head structure of a magnetic head, comprising the steps  
2 of:

3 fabricating a plurality of thin film layers to create a GMR sensor, said layers including a  
4 free magnetic layer having a central portion and outwardly disposed end portions;

5 fabricating at least two magnetic layers above said end portions of said free magnetic  
6 layer, wherein said at least two magnetic layers have magnetic fields that are anti-parallel  
7 coupled.

1 31. A method for fabricating a read head structure as described in claim 30, including the  
2 steps of:

3 fabricating a seed layer on top of said end portions of said free magnetic layer;

4 fabricating a first said magnetic layer on top of said seed layer;

5 fabricating a nonmagnetic layer above said first magnetic layer; and

6 fabricating a second said magnetic layer above said nonmagnetic layer.

1 32. A method for fabricating a read head structure as described in claim 31, wherein a net  
2 magnetostatic field is produced by said anti-parallel coupled magnetic layers, said net  
3 magnetostatic field being formed in the same direction as a magnetic field of said free magnetic  
4 layer.

1 33. A method for fabricating a read head structure as described in claim 31 wherein said seed  
2 layer is comprised of CoFeCr, said first magnetic layer is comprised of CoPtCr, said  
3 nonmagnetic layer is comprised of Ru and said second magnetic layer is comprised of CoPtCr.

1 34. A method for fabricating a read head structure as described in claim 33 wherein said seed  
2 layer is fabricated with a BCC crystal structure.

1 35. A method for fabricating a read head structure as described in claim 34 including the  
2 further steps of fabricating a layer comprised of CoFe between said first magnetic layer and said  
3 nonmagnetic layer, and fabricating a second layer comprised of CoFe between said nonmagnetic  
4 layer and said second magnetic layer.